Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Withdrawn) A composite catalyst for producing synthesis gas, said catalyst comprising a mixture of at least two distinct populations of particles and said catalyst having activity for converting reactive species comprising at least one gaseous hydrocarbon and oxygen via partial oxidation to form carbon monoxide and hydrogen,

wherein a first of said populations comprises a first plurality of particles comprising at least one catalytic metal disposed on a first support, wherein said catalytic metal comprises a metal chosen from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof, and

wherein a second of said populations comprises a second plurality of particles comprising at least one promoter disposed on a second support, wherein said at least one promoter is chosen from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof,

said first and said second pluralities of particles being mixed, formed into distinct structures and calcined in such a way that said first and said second reactive species can spillover between said catalytic metal and said promoter.

2-17. (Canceled)

19. (Currently amended) A method for making a ~~synthesis gas~~ composite catalyst suitable to promote the conversion of reactive species comprising oxygen and at least one light hydrocarbon to synthesis gas, the method comprising the steps of:

(a) depositing a first active metal on a first plurality of particles of a first support material;

(b) depositing a first promoter on a second plurality of particles of a second support material;

(c) mixing said first and second pluralities of particles of said first and said second support materials; and

(d) forming said mixture of particles into distinct structures,

wherein said mixing and forming steps are performed in such a way that said reactive species can spillover between said first active metal and said first promoter when said catalyst is in service and under reaction conditions.

20. (Original) The method of claim 19 wherein said first active metal comprises a metal selected from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof.

21. (Currently amended) The method of claim 20 further comprising the step of:

~~(d)~~ (e) before step (c), depositing a second active metal on said first plurality of particles of said first support material, said second active metal being selected from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof.

22. (Canceled)

23. (Currently amended) The method of claim [[22]] 19 wherein a majority of each of said first and second pluralities of particles have a diameter less than 5 microns.

24. (Currently amended) The method of claim [[23]] 19 wherein a majority of each of said first and second pluralities of particles have a diameter less than 1 micron.

25. (Original) The method of claim 19 wherein said first promoter is chosen from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof.

26. (Currently amended) The method of claim 25 further comprising the step of:

~~(d)~~ (e) before step (c), depositing a second promoter on said second plurality of particles of said second support material, said second promoter being chosen from the

group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof.

27. (Original) The method of claim 19 wherein said first and said second support materials are each made using at least one material chosen from the group consisting of boehmite, pseudo-boehmite, alumina, zirconia, magnesia, titania, ceria, thoria, boria, cordierite, mullite, silica, niobia, vanadia, nitrides, and carbides.

28. (Original) The method of claim 19 wherein said first and said second support materials each comprise at least one material chosen from the group consisting of alumina, zirconia, magnesia, titania, ceria, thoria, boria, cordierite, mullite, silica, niobia, vanadia, nitrides, and carbides.

29. (Original) The method of claim 28 wherein at least one of said first and said second supports further comprises at least one structural stabilizer selected from the group consisting of B, Mg, Si, Ca, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Se, Sr, Zr, Ba, Sc, Y, La, Ce, Nd, Pr, and Sm.

30. (Original) The method of claim 19 wherein at least one of said first and said second supports includes a refractory material selected from the group consisting of aluminum oxide, zirconium oxide, titanium oxide, silicon oxide, and combinations thereof and a structural stabilizer selected from the group consisting of B, Mg, Si, Ca, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Sr, Zr, Ba, Se, Sc, Y, La, Ce, Nd, Pr, Sm, and combinations thereof.

31. (Currently amended) The method of claim [[28]] 19 wherein said first and said second support materials comprise the same material.

32. (Original) The method of claim 19 wherein said first active metal comprises Rh and said first promoter comprises Sm.

33. (Withdrawn) A method for making synthesis gas comprising the steps of:

(a) contacting a first reactive species comprising oxygen and a second reactive species comprising at least one light hydrocarbon with a catalyst at reaction conditions, said catalyst comprising:

a first active metal disposed on a first plurality of support particles, wherein said first active metal comprises a metal selected from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof; and

a first promoter disposed on a second plurality of support particles, wherein said first promoter is chosen from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof,

said first and said second pluralities of support particles being mixed, formed into distinct structures and calcined in such a way that said first and said second reactive species can spillover between said first active metal and said first promoter; and

(b) converting a portion of said second reactive species to form a product comprising hydrogen and carbon monoxide.

34-35. (Canceled)

36. (Withdrawn) The method of claim 33 wherein a majority of said first and said second pluralities of support particles have a diameter less than 5 microns.

37-40. (Canceled)

41. (Withdrawn) The method of claim 33 wherein said first and said second pluralities of support particles each comprise at least one refractory material chosen from the group consisting of alumina, zirconia, magnesia, titania, ceria, thoria, boria, cordierite, mullite, silica, niobia, vanadia, nitrides, and carbides.

42-43. (Canceled)

44. (Withdrawn) The method of claim [[41]] 33 wherein said first and said second pluralities of support particles have at least one material in common.

45. (Withdrawn) The method of claim 33 wherein said first active metal comprises Rh and said first promoter comprises Sm.

46-48. (Canceled)

49. (New) The method of claim 32 wherein the catalyst comprises 0.05 - 25 wt% Rh and 0.1 - 10 wt% Sm (based on total weight of the catalyst).

50. (New) The method of claim 19 wherein at least 50% of the distinct structures have a maximum characteristic length of less than six millimeters.

51. (New) The method of claim 19 wherein at least 50% of the distinct structures have a maximum characteristic length of less than 3 millimeters.

52. (New) The method of claim 19 wherein the distinct structures range in size from 50 microns to 6 millimeters in diameter.

53. (New) The method of claim 19 wherein the distinct structures range in size from about 300 microns to about 3 millimeters.

54. (New) The method of claim 19 wherein said first and said second supports comprise the same support material.

55. (New) The method of claim 19 wherein the forming step comprises applying pressure to said mixture of particles to make said distinct catalyst structures.

56. (New) A method for making a synthesis gas catalyst suitable to promote the conversion of reactive species comprising oxygen and at least one light hydrocarbon, the method comprising the steps of:

(a) depositing a catalytic metal on a first plurality of support particles, wherein a majority of said first plurality of support particles are less than 10 microns in diameter;

(b) depositing a promoter on a second plurality of support particles, wherein a majority of said second plurality of support particles are less than 10 microns in diameter;

(c) mixing said deposited first and said second pluralities of particles from the deposition steps (a) and (b);

(d) forming said mixture of particles into catalyst structures; and

(e) calcining said catalyst structures.

57. (New) The method of claim 56 wherein the deposition step (a) is carried out by impregnation.

58. (New) The method of claim 56 wherein the deposition step (b) is carried out by impregnation.

59. (New) The method of claim 56 wherein the deposition step (a) is carried out by washcoating.

60. (New) The method of claim 56 wherein the deposition step (b) is carried out by washcoating.

61. (New) The method of claim 56 wherein said forming step (d) comprises applying pressure to said mixture of particles to make said distinct catalyst structures.

62. (New) The method of claim 56 wherein said forming step (d) comprises extruding said mixture of particles to make said distinct catalyst structures.

63. (New) The method of claim 56 further comprising separately calcining the deposited first and second pluralities of particles after steps (a) and (b) before the mixing step (c) is performed.

64. (New) The method of claim 56 wherein said catalyst structures comprise granules, beads, pills, pellets, cylinders, trilobes, extrudates, rings, or spheres.

65. (New) The method of claim 56 wherein said first and said second plurality of particles comprise the same support material.

66. (New) The method of claim 56 wherein a majority of each of said first and said second plurality of support particles are less than 5 microns in diameter.

67. (New) The method of claim 56 wherein said catalytic metal comprises a metal selected from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof.

68. (New) The method of claim 56 wherein said catalytic metal comprises Rh.

69. (New) The method of claim 56 wherein said promoter is chosen from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof.

70. (New) A method for making a composite catalyst suitable to promote the conversion of reactive species comprising oxygen and at least one light hydrocarbon to synthesis gas, the method comprising the steps of:

depositing a catalytic metal on a first plurality of support particles, wherein said catalytic metal comprises a metal selected from the group consisting of Rh, Pd, Ru, Os, Ir, Pt, Co, Ni, Re, and oxides thereof;

calcining said deposited first plurality of support particles;

depositing a promoter on a second plurality of support particles, wherein said promoter is chosen from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and oxides thereof;

calcining said deposited first plurality of support particles;

mixing the deposited calcined first and said second pluralities of particles;

forming said mixture of particles into distinct catalyst structures; and

calcining said catalyst structures.

71. (New) The method of claim 70 wherein the forming step comprises pressing said mixture of particles together to make catalyst pellets.

72. (New) The method of claim 70 wherein depositing the catalytic metal and depositing the promoter are carried out by impregnation.

73. (New) The method of claim 70 wherein a majority of each of said first and said second plurality of support particles are less than 10 microns in diameter.

74. (New) The method of claim 70 wherein said first and said second supports comprise the same support material.

75. (New) The method of claim 70 wherein said catalytic metal comprises Rh.

76. (New) The method of claim 70 wherein the first and second pluralities of support particles comprise an alumina powder.